

Saddleback Ridge Wind, LLC // Natural Resource Protection Act
(NRPA) and Site Location of Development Act applications

- Testimony of Dr. Doris Mills at BEP rulemaking hearing
July 7, 2011

AR-86

TESTIMONY OF DORA ANNE MILLS, MD, MPH
IN OPPOSITION TO
RULE CHANGES TO MAINE DEP CHAPTER 375 REGULATIONS ON
WIND TURBINE NOISE

JULY 7, 2011

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JULY 7, 2011 TESTIMONY

Introduction

My name is Dora Anne Mills. I am here today as a member of the public, and I am not paid by anyone or any organization to be here. Although I very recently learned of this hearing, I wanted to be here today to share some perspectives from my involvement in this issue over the last 2 ½ years.

I am a medical doctor who is board certified in pediatrics and who has a masters of public health. As Maine's public health director for nearly 15 years (the Director of what has been known as the Maine CDC the past several years), I was often tasked with conducting scientific literature reviews and forming a response for the Executive Branch for Maine, under both Governor Angus King and Governor John Baldacci as well as for four different commissioners of the Department of Health and Human Services. I conducted such searches on many topics over the years, including on: thimerosal in vaccines, decommissioning of nuclear power plants, MTBE contamination of well water, mercury in dental amalgam, BPA exposure in children's products, cell phones and radiation exposure, smart meters and radiation exposure, and many more. I was fortunate to be able to conduct such reviews impartially, regardless of sometimes previously stated administrations' viewpoints or the surrounding political climate.

2009 – Initial Involvement with Noise and Wind Projects

One such search came to my attention during the winter of 2009 when I received a phone call from Dr. Albert Aniel of Rumford. He and I talked for about an hour, during which time he shared with me concerns he had regarding the impact of wind turbines on human health. I asked him to send me any information he had on the topic, including web links or copies of peer-reviewed literature. Because he told me that he and some colleagues from the local hospital were imminently and publicly calling for a moratorium on all wind projects in Maine, I quickly turned my attention to this matter, spending a number of hours over several days and nights reading as much as I could on the subject, including several websites and documents Dr. Aniel sent to me as well as a variety of articles I found from a literature review.

I found much of the information sent to me by Dr. Aniel (and subsequently some others also supporting a wind turbine moratorium) was not scientifically based. The articles cited by them were primarily either from non-peer-reviewed journals (though some were labeled as "peer-reviewed"), lacked scientific methodology, or were misinterpreted analyses from peer-reviewed journals. For instance, work done by the often-quoted Dr. Nina Pierpont lacked some aspects of scientific methodology, and was labeled "peer-reviewed" when it in fact was not. (The term "peer-reviewed" generally means that a study has been reviewed in a double blind fashion, i.e. neither the paper's authors nor the reviewers are identified to each other.) A survey conducted by Dr. Nissembaum in the

Mars Hill area likewise lacked some basic scientific methodology, leading to such probable and very significant problems as recall biases.

Over the course of subsequent weeks I also talked with several experts and colleagues on the subject, including my co-workers at Maine DEP, their noise consultant, Dr. Peter Rabinowitz (who is an occupational and environmental health physician at Yale University), and others. Since I am not a noise expert, I reached out to experts for assistance in interpreting some technical aspects of some of the studies I was reviewing. I also reached out to Maine DEP staff for background related to their regulations. During our many verbal conversations and emails, I asked numerous questions. Some of these questions or comments have been extracted from emails and interpreted by some to mean that I was in opposition to Maine DEP's current rules or was jumping to conclusions. However, that is not true; these emails were part of a much bigger discussion among colleagues taking place in different modalities over a course of weeks and even months.

I was not pressured to come to any specific conclusion by Maine DEP, anyone else in Governor Baldacci's administration, or others whom I had worked with. My main interest was to review and interpret the scientific literature and form an opinion that would be in the best interest for public health.

Unfortunately I did not have time to write a full report. A hectic legislative session, a broken leg with resulting surgery, lack of staff at Maine CDC to assist me in this review, and the outbreak of H1N1 consumed my time during much of 2009. However, I did post a few summary notes and an opinion piece on Maine CDC's website.

My overall conclusion is summarized by the opinion piece I wrote in June of that year for the *Portland Press Herald*. It is included at the end of this testimony. An excerpt from it is as follows:

"I found no evidence of adverse health effects from the noise generated by wind turbines except for those associated with annoyances from the audible noises. These effects, however, are mitigated or disappear with proper placement of the turbines from nearby residences. So, although the noise qualities are different, it seems as though what was found to be true of airports and highways is true of wind turbines: It is primarily a matter of distance. However, there is no one proper distance for all wind turbines. Research indicates that a number of factors determine proper placement, including the height of the wind turbine, the surrounding topography, wind conditions, and wind direction. As with airports, annoyance levels are difficult to assess and vary from person to person. Careful measurements of different noise frequencies in a variety of weather conditions should assure proper placement of wind turbines that protect against annoyances and resulting effects."

Maine Medical Association Resolution

During the spring and summer of 2009 I was also part of a committee of the Maine Medical Association (MMA) that looked into wind projects and noise. The issue was

brought to the committee by Dr. Aniel, who was calling for a moratorium on all wind projects and who requested them to introduce a resolution on wind power and health at the MMA's annual meeting. My recall is that this issue was discussed at five meetings over a period of several months by the MMA's Public Health Committee and/or a subcommittee. At least one of the discussions on this topic was several hours in length.

At the end of August, about 10 days before the MMA's annual meeting, the committee voted 8 to 1 not to move forward with a resolution put forth by Dr. Aniel. Several of us, including myself, who spent time on this issue and would have also voted with the 8, were not in attendance at that meeting. After the vote, we believed that was the end of such a resolution.

However, at the annual meeting a few days later, Dr. Aniel introduced a similar resolution. Almost no members of the Public Health Committee who spent many hours on this subject were present during that part of the annual meeting. One member, Dr. Richard Jennings, who was present and was against the original resolution told us later that the resolution introduced there was presented differently and very innocuously, such that he himself voted for it, though he publicly stated later that he regretted that vote.

The resolution passed and is included in the appendix. The verbiage of the recommendations piece in the resolution is in some ways fairly innocuous, focusing only on "potential health effects" and recommending studies on these potential health effects "by independent qualified researchers at qualified research institutions".

However, this resolution was then widely used by opponents of wind power as evidence for the existence of health effects and to support a moratorium. It has been distributed on numerous websites around the world as well as used here in Maine as an argument against specific wind projects. Yet, what is left out of these distributions is that after several months of discussion and meetings on this topic, the Maine Medical Association's Public Health Committee voted virtually unanimously against a similar resolution on wind power. And, the resolution that did pass did not recognize health effects from wind power. Its statement was mainly one of encouraging a scientific approach to the issue.

2010 – 2011

During the last two years I have visited several wind projects. One of the visits, in the fall of 2010, was at the request of neighbors of the Beaver Ridge Project in Freedom. Andy Fisk, at the time a colleague of mine at Maine DEP, and I visited together for about an hour with 15 or so neighbors. Some of the homes were quite close to the wind project, about 1,000 – 1,500 feet. The noise levels from this project on the day we visited seemed fairly loud and annoying. Unfortunately, the state noise regulations at the time this project was built did not apply to this project. The lesson to me from this visit, as well as from hearing about the experiences in Mars Hill and Vinalhaven, was that the state noise regulations with current modeling should at a minimum be adhered to statewide. It is my understanding from my former colleagues at Maine DEP that where the state regulations

have been strictly complied with, and combined with current modeling, there have been no significant problems with annoyances.

In the fall of 2010 I also posted an updated summary of the literature, since other organizations had since reviewed this topic. A summary of my findings was included in a letter to the editor of the *Sun Journal* published on November 3, 2010. I include the text of that letter below this testimony as well as a summary update of the Maine CDC website on this topic. In brief, since my original review in 2009, reviews or studies on this topic were conducted and published by the Wisconsin PUC, Minnesota Department of Health, the Chief Medical Officer of Health for Ontario, and the Australian government's National Health and Medical Research Council. They all made similar conclusions — that there is no evidence of a direct health or disease impact from wind turbines, especially if properly placed.

In preparation for this hearing today, I also read through the pre-hearing submissions by the proponents of the rule change as well as did a quick updated online literature review of the issue. I did not find anything new to lead to different conclusions.

Conclusion

In conclusion, there is no credible scientific evidence at this time supporting directly caused health problems, diseases or syndromes resulting from wind turbines that are in compliance with Maine's regulations and current modeling strategies. It also appears the current scientific literature supports Maine's regulations of a 45 dBA *one hour average* nighttime limit. A 2009 report on nighttime noise by the World Health Organization (WHO) recommends a 40 dBA *annual* average as being protective of human health. It is my understanding that Maine's hourly cap of 45 dBA is more stringent than this WHO 40 dBA annual limit.

It is also important to look at the overall public health issues before us. Generating energy from wind turbines means less energy generated from foreign oil and coal, both being major contributors to global warming, pollution, and resulting diseases and deaths due to heart disease, cancer, asthma, and other lung diseases.

Maine's highest-in-the-nation rates of asthma and cancer are thought to be at least partially due to pollution from our dependence on fossil fuels. If there is any evidence for a moratorium or stricter regulations, it is most likely on the further use of fossil fuels, given their known and common ill effects on the health of our population.

Wind turbines play an important role in a vision of Maine generating energy that harnesses our own clean resources and improves the overall health of Maine. However, like any source of noise, proper placement away from residences is important.

My reading of current scientific literature leads me to conclude that Maine DEP regulations and current testing protocols and modeling serve to properly place turbines, and when combined with community input, can help us achieve the vision of a healthier Maine.

APPENDIX

NOVEMBER, 2010 *SUN JOURNAL* LETTER TO EDITOR

Letter to the Editor Appearing in the *Sun Journal* on November 3, 2010

By Dora Anne Mills, M.D.

There are several points I believe are worth making in response to recent debate on wind development and health issues.

There is a lot of misleading information on the Internet about wind power and health. This includes studies that are self-proclaimed as being peer-reviewed when they are not, and websites that proclaim specific syndromes and diseases resulting from the noise produced by wind turbines.

In recent months, several government agencies have conducted reviews of the science, including the Wisconsin PUC, Minnesota Department of Health, the Chief Medical Officer of Health for Ontario, and the Australian government's National Health and Medical Research Council. They all have made similar conclusions — that there is no evidence of a direct health or disease impact from wind turbines, especially if properly placed.

Maine's regulations provide for health protection, assuring appropriate placement away from residences, and are within or comparable to the 2009 World Health Organization's recommendations.

The Maine Medical Association's 2009 resolution on this issue is often mischaracterized. The organization did not recognize health effects from wind power. Its statement was mainly one of encouraging a scientific approach to the issue.

Wind power energy means less from coal and foreign oil, both being major contributors to global warming and diseases such as cancer, asthma and heart disease.

Community involvement is critical in the decision-making process about wind development. However, there is no credible scientific evidence at this time supporting diseases or syndromes resulting from wind turbines that are in compliance with state regulations.

Dora Anne Mills, M.D., Augusta

Director, Maine Center for Disease Control and Prevention

NOVEMBER, 2010 REFERENCES FOR *SUN JOURNAL* LETTER TO EDITOR

Australia

July 2010, by the Australian Government's National Health and Medical Research Council, "Wind Turbines and Health"

Conclusion: "The Public Statement presents the current evidence relating potential health impacts of wind turbines on people living in close proximity. The Statement concludes that there is currently no published scientific evidence to positively link wind turbines with adverse health effects."

<http://www.nhmrc.gov.au/publications/synopses/new0048.htm>

Ontario

May 2010, by Dr. Arlene King, Chief Medical Officer of Health for Ontario, "The Potential Health Impact of Wind Turbines"

Conclusion:

"The report concludes that:

- While some people living nearby wind turbines report symptoms such as dizziness, headaches and sleep disturbance, available scientific evidence to date does not demonstrate a direct causal link between wind turbine noise and adverse health effects.
- The sound level from wind turbines at common residential setbacks is not sufficient to cause hearing impairment or other direct adverse health effects, but it may annoy some people."

"According to the scientific evidence, there isn't any direct causal link between wind turbine noise and adverse health effects."

http://www.health.gov.on.ca/en/news/release/2010/may/nr_20100520.aspx

Wisconsin

Report for the Wisconsin Public Service Commission

October 2009, "Evaluation of the Scientific Literature on the Health Effects Associated with Wind Turbines and Low Frequency Sound" by Exponent, an Illinois-based engineering and scientific consulting firm

"As of this review, there has not been a specific health condition documented in the peer reviewed published literature to be classified as a disease caused by exposure to sound levels and frequencies generated by the operation of wind turbines." And

"It is clear that some people respond negatively to the noise qualities generated by the operation of wind turbines, but there is no peer-reviewed, scientific data to support a claim that wind turbines are causing disease or specific health conditions."

<http://www.maine.gov/dhhs/boh/wind-turbines.shtml>

Minnesota

May, 2009, Minnesota Department of Health, Environmental Health Division,
"Public Health Impacts of Wind Turbines"

"The most common complaint in various studies of wind turbine effects on people is annoyance or an impact on quality of life. Sleeplessness and headache are the most common health complaints and are highly correlated (but not perfectly correlated) with annoyance complaints."

VII. Recommendations

To assure informed decisions:

Wind turbine noise estimates should include cumulative impacts (40-50 dB(A) isopleths) of all wind turbines. Isopleths for dB(C) - dB(A) greater than 10 dB should also be determined to evaluate the low frequency noise component. Potential impacts from shadow flicker and turbine visibility should be evaluated. Any noise criteria beyond current state standards used for placement of wind turbines should reflect priorities and attitudes of the community.

World Health Organization

Nighttime Noise Guidelines for Europe, 2009

<http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/noise/publications/2009/night-noise-guidelines-for-europe>

JUNE, 2009 PORTLAND PRESS HERALD OPINION PIECE

Are wind turbines health hazards?

(Originally printed in the *Portland Press Herald's Maine Voices*)

DORA ANNE MILLS June 21, 2009

Recently, questions have been raised about possible health effects from the noise produced by wind turbines.

After reviewing the medical and public health literature and conducting interviews with experts, I have developed some conclusions to these questions.

- **Are there health effects from noise generated by wind turbines?**

Noise generated by wind turbines can produce a low-frequency repetitive swishing sound that by some reports can be very annoying.

There are claims that turbines also generate very low-frequency noise outside the range of hearing that is alleged to cause health effects.

In my reading of peer-reviewed medical and public health literature, mostly from Europe and Canada, I found no evidence of adverse health effects from the noise generated by wind turbines except for those associated with annoyances from the audible noises.

These effects, however, are mitigated or disappear with proper placement of the turbines from nearby residences.

So, although the noise qualities are different, it seems as though what was found to be true of airports and highways is true of wind turbines: It is primarily a matter of distance.

However, there is no one proper distance for all wind turbines.

Research indicates that a number of factors determine proper placement, including the height of the wind turbine, the surrounding topography, wind conditions, and wind direction.

As with airports, annoyance levels are difficult to assess and vary from person to person.

Careful measurements of different noise frequencies in a variety of weather conditions should assure proper placement of wind turbines that protect against annoyances and resulting effects.

- **Does Maine law assure proper placement of wind turbines from residences?**

Maine Department of Environmental Protection rules recognize that excessive noise can degrade the health and welfare of nearby neighbors. The rules set noise limits based on the type of development in the area and as measured at the boundary of the property owned by the developer. These rules serve to ensure that a turbine is located at a sufficient distance from homes so there are not annoying levels of noise.

Maine DEP, using professional noise experts, evaluates proposed wind turbine developments using measurements of high and low frequency noise and requires wind farms to demonstrate compliance with enforceable noise limits.

A number of states and countries have no such noise regulations, and of those that have them, Maine's compare very favorably in the protections they offer.

- **What are the health benefits from wind turbines?**

Generating energy from wind turbines means less energy generated from foreign oil and coal, both being major contributors to global warming, pollution, and resulting diseases and deaths due to heart disease, cancer, asthma, and other lung diseases.

Maine's highest-in-the-nation rates of asthma and cancer are thought to be at least partially due to pollution from our dependence on fossil fuels.

According to the Maine DEP, if Maine generated 5 percent of its electricity from wind power, there would be significant pollution cuts, including annual amounts of almost a half-million tons of carbon dioxide, about 250 tons of sulfur dioxide, and about 150 tons of nitrogen oxide.

- **What about a moratorium on wind turbine projects?**

In researching and reading several dozen papers and other sources of information I do not find evidence to support a moratorium on wind turbine projects.

The articles cited by those who are in favor of a moratorium are primarily either from non-peer-reviewed journals (though some are labeled as "peer-reviewed") or are misinterpreted analyses from peer-reviewed journals.

If there is any evidence for a moratorium, it is most likely on the further use of fossil fuels, given their known and common ill effects on the health of our population.

Wind turbines play an important role in a vision of Maine generating energy that harnesses our own clean resources and improves the overall health of Maine. However, like any source of noise, proper placement away from residences is important.

Maine DEP regulations and current testing protocols serve to properly place turbines, and when combined with community input, can help us achieve the vision of a healthier Maine.

SPRING 2009 SUMMARY NOTES POSTED ON MAINE CDC'S WEBSITE

Wind Turbines Neuro-Acoustical Issues

**Dora Anne Mills, MD, MPH Maine CDC/DHHS
June, 2009**

1. What protections are in Maine law regarding excessive noise and vibrations?

Maine DEP has rules that apply to all developments in unorganized areas of the state and in all municipalities without a more restrictive noise ordinance. The rules recognize in its text that excessive noise can degrade health and welfare of nearby neighbors, and they provide limits based on the type of development in the area surrounding the noise. For instance, they limit noise levels for routine operation of a proposed development: to 75 dBA at any time; to 60 dBA during the daytime and 50 dBA during the nighttime for non-commercial and non-industrial areas; and to 55 dBA daytime and 45 dBA nighttime for areas in which ambient sounds are 45 dBA or less daytime or 35 dBA or less nighttime.

Maine DEP also has retained the services of a noise expert to review noise study submissions as part of wind turbine applications and compliance evaluations.

DEP's ambient, post development monitoring at the Mars Hill wind farm shows dBA levels higher than 45, sometimes exceeding 60 when there are windy conditions both at ground level and at turbine height. This presents an example of how ambient noise from wind at these locations (which is why turbines are placed there) is in excess of the optimal nighttime 45 dBA. The DEP rules and compliance monitoring provide for distinguishing between the ambient contribution to noise and that from turbines at wind farms.

In summary: Maine law appears to essentially place a 45 dBA noise limit on most wind turbine projects in Maine. A 5 dBA variance to limits may be granted upon specific findings that concern pre-development existing ambient noises that are in excess of a particular standard. For compliance with the rule, noise levels are measured at the boundary of the property owned by the proposed developer.

Sources:

- Maine DEP rule-making authority on noise is in Title 38 Section 343
- Rules are in Chapter 375, Section 10:
<http://www.maine.gov/sos/cec/rules/06/096/096c375.doc>
- Maine SPO Noise Technical Assistance Bulletin
<http://www.maine.gov/spo/landuse/docs/techassist/techassistbulletins/noisetabulletin.pdf>

2. What do different noise levels compare to?

40 dBA is comparable to a quiet room. 55 dBA is comparable to a household room or office in which there is normal background vibration and sounds such as is commonly found from household appliances.

COMPARISON OF SOUND PRESSURE LEVEL AND SOUND PRESSURE		
Sound Pressure Level, dB		Sound Pressure, Pa
	120	20
Pneumatic Chipper (at 5 ft)	110	10
Textile Loom		5
Newspaper Press	100	2
		1
Diesel Truck 40 mph (at 50 ft)	90	0.5
	80	0.2
	70	0.1
Passenger Car 50 mph (at 50 ft)		0.05
Conversation (at 3 ft)	60	0.02
	50	0.01
		0.005
Quiet Room	40	0.002
	30	0.001
		0.0005
	20	0.0002
	10	0.0001
		0.00005
	0	0.00002
		Rock-n-Roll Band
		Power Lawn Mower (at operator's ear)
		Milling Machine (at 4 ft)
		Garbage Disposal (at 3 ft)
		Vacuum Cleaner
		Air Conditioning (Window Unit at 25 ft)

Canadian Centre for Occupational Health and Safety
(see www.ccohs.ca/oshanswers/phys_agents/noise_basic.html).

3. What kinds of noises are expected from wind turbines?

According to several resources, new wind turbines are relatively quiet, and meet federal and international standards and regulations for noise, including Maine's regulations. According to the US Department of Energy, a modern wind farm at a distance of 750 – 1,000' is no louder than a kitchen refrigerator or a moderately quiet room.

However, there are people who live about these distances from wind turbines who disagree with this federal agency statement. It appears from the research that distance from the wind turbine, height of the wind turbine relative to the surrounding topography, the quality of the sound (repetitive low frequency sound), wind conditions, and wind direction all affect how the wind turbine noise affects people. Research done on wind turbines, airport and other sources of noise indicates that annoyance levels are difficult to assess. However, taking in account the above factors as well as careful measurements need to be considered when siting wind turbines near residential properties.

Sources:

- US Dept. of Energy's Wind Energy Guide for County Commissioners: <http://www.nrel.gov/wind/pdfs/40403.pdf>
- Page 6: An operating modern wind farm at a distance of 750'-1,000' is no louder than a kitchen refrigerator or moderately quiet room.
- University of Massachusetts Renewable Research Energy Laboratory: http://www.windpoweringamerica.gov/pdfs/workshops/mwwwg_turbine_noise.pdf
Contains a number of resources on sounds emitted from wind turbines
- Noise levels of small residential wind turbines:
[Dept. of Energy's Consumer Guide on Small Wind Turbines](#)
Comparable sounds to wind turbines
- [Wind Turbine Noise Issues: A white paper prepared by Renewable Energy Research Laboratory, U of Massachusetts, 2004](#)

4. Are there health effects to the levels of sound heard by wind turbines?

According to a 2003 Swedish EPA review of noise and wind turbines:

"Interference with communication and noise-induced hearing loss is not an issue when studying effects of noise from wind turbines as the exposure levels are too low."

In my review I found no evidence in peer-reviewed medical and public health literature of adverse health effects from the kinds of noise and vibrations heard by wind turbines other than occasional reports of annoyances, and these are mitigated or disappear with proper placement of the turbines from nearby residences. Most studies showing some health effects of noise have been done using thresholds of 70 dBA or higher outdoors, much higher than what is seen in wind turbines.

Sleep disturbance is another commonly raised concern, and the WHO guidelines for community noise recommend that nighttime outdoor noise levels in residential areas not exceed 45 dBA, which is consistent with Maine law.

Sources:

- [Noise Annoyance from Wind Turbines – A Review 2003 Sweden Environmental Protection Agency](#)
This study found no evidence of health problems, reviews the variety of noise regulation laws in place in Europe
- [British Medical Journal 2007 Swedish Study \(Eja Pedersen\)](#)
Survey in Sweden of residents near wind turbines found annoyance increased with increased sound pressure levels (SPLs), and increased annoyance was associated with lower sleep quality and negative emotions.
- [Noise Pollution: Non-Auditory Effects on Health, 2003](#)
- [World Health Organization Community and Occupational Noise](#)
- [World Health Organization 2002 Technical Meeting on Relationship Between Noise and Health](#)
Page 52 says that WHO standard is for nighttime noise not to exceed 45 dBA.

5. What about low frequency noises (LFN)?

Some have pointed to LFN emitted from wind turbines as a possible source of adverse health effects. The reasons LFN are focused on include: LFN encounter less absorption as they travel through air than higher frequency sound, so they persist for a longer distance; the amount of sound transmitted from the outside to the inside of a building is higher with LFN; and some models for assessing impact of noise do not adequately include LFN.

Low frequency and infrasound (lower than what is perceptible) vibrations are very common in our background, and known to be emitted from many household appliances and vehicles as well as in neighborhoods near airports and trains. Exposure to very intense LFN can be annoying and may adversely affect overall health, though these levels appear to be more intense than what is measured from modern wind turbines.

The DEP noise regulations are based on the “A” frequency range of noise, which measures the higher frequency end of the noise spectrum, and is denoted with the term dBA. Because the dB measurement deemphasizes noises from the lower end of the frequency spectrum (or “C” weighted noise, dB), Maine DEP has been evaluating noise models and predicted noise levels from proposed wind power facilities using a handicapping system that requires an applicant to prove that dB noise levels will be at such a level at property boundaries that they are effectively controlling for low frequency noises in the dB range. The Land Use Regulation Commission has required monitoring for dBC noise at one of its recently permitted wind turbine facilities in order to evaluate dBC noise levels at property boundaries.

One recent study commonly cited by proponents of the belief of the physiological impacts of LFN is: “Tuning and sensitivity of the human vestibular system to low-frequency vibration”, Todd, et al. Neuroscience Letters, 2008, which can be found at: <http://www.ncbi.nlm.nih.gov/pubmed/18706484>. This study indicates that the human vestibular system is sensitive, which means it shows a physiological response, to low frequency and infrasound vibrations of -70 dB, indicating that human seismic receptor sensitivity of the vestibular system may possibly be on par with the frog ear. However, sensitivity, i.e. showing a physiological response, does not mean there are adverse effects.

Summary:

Reviews found in peer-reviewed journals of the possible health effects of low frequency noise have not found evidence of significant health effects (several references are listed below).

Sources:

- Infrasound from Wind Turbines: Fact, Fiction, or Deception? Journal of Canadian Acoustics, Volume 34, no 2,

2006. <http://www.wind.appstate.edu/reports/06-06Leventhall-Infras-WT-CanAcoustics2.pdf>

"Infrasound from wind turbines is below the audible threshold and of no consequence. Low frequency noise is normally not a problem, except under conditions of unusually turbulent in flow air. The problem noise from wind turbines is the fluctuating swish. This may be mistakenly referred to as infrasound by those with a limited knowledge of acoustics, but it is entirely in the normal audio range and is typically 500Hz to 1000Hz. It is difficult to have a useful discourse with objectors whilst they continue to use acoustical terms incorrectly. This is unfortunate, as there are wind turbine installations that may have noise problems. It is the swish noise on which attention should be focused, in order to reduce it and to obtain a proper estimate of its effects. It will then be the responsibility of legislators to fix the criterion levels. However, although the needs of sensitive persons may influence decisions, limits are not normally set to satisfy the most sensitive."

- Sources and Effects of Low-Frequency Noise 1996
J. Acoust. Soc. Am. Volume 99, Issue 5, pp. 2985-3002 (May 1996)
- Characteristics of low frequency signals emitted from home electric appliances:
- Magnetic Emission Ranking of Electrical Appliances
- International Meeting on Low Frequency Noise and Vibration and Its Control, the Netherlands, 2004

6. What are the health benefits to wind turbines?

- There are tremendous potential health benefits to wind turbines, including reductions in deaths, disability, and disease due to asthma, other lung diseases, heart disease, and cancer. Maine has among the highest rates in the country of asthma and cancer.
- Wind turbines mean less dependency on foreign oil and coal that contribute to global warming and pollution (coal produces carbon dioxide, acid rain, smog, particulate pollution, carbon monoxide, and mercury), which in turn contribute to the diseases above.
- According to the Maine DEP, if Maine generated 5% of its electricity from wind power, there would be significant pollution cuts:
 - 464,520 tons per year of CO₂
 - 252 tons per year of SO₂
 - 147 tons per year of NO_x

7. What about a moratorium on wind turbine projects?

- I do not find evidence to support a moratorium on wind turbine projects at this time. The articles cited by those who are in favor of a moratorium are either from non-peer reviewed journals (though some are labeled as "peer reviewed") or are misinterpreted analyses from peer-reviewed journals.
- If there is any evidence for a moratorium, it is most likely on further use of fossil fuels, given their known and common effects on the health of our population.

Basic Wind Turbine Noise-Related Resources

- US Dept. of Energy's New England Wind Power Website on Wind Turbine Sound – this has a good summary and links to references
- Massachusetts DEP Regulations
"A source of sound will be considered to be violating the Department's noise regulation (310 CMR 7.10) if the source: Increases the broadband sound level by more than 10 dB(A) above ambient, or Produces a "pure tone" condition - when any octave band center frequency sound pressure level exceeds the two adjacent center frequency sound pressure levels by 3 decibels or more. These criteria are measured both at the property line and at the nearest inhabited residence. Ambient is defined as the background A-weighted sound level that is exceeded 90% of the time measured during equipment operating hours. The ambient may also be established by other means with the consent of the Department."
- Ongoing Research is being done by the US Dept. of Energy Wind Turbine Aeroacoustic Research:
"Turbine noise can be caused by rotor speed, blade shape, tower shadow, and other factors. The program is sponsoring both wind tunnel and field tests to develop a noise prediction code that turbine manufacturers can use to ensure that new rotor designs and full systems aren't too noisy. This is especially true for high-growth U.S. markets for small wind turbines that will demand quieter rotors, especially when turbines are sited in residential neighborhoods. Small turbines operate at high rotational speeds and tend to spin even if they are furled (pointed out of the wind).
- **Background Information on Noise:**
 - http://www.osha.gov/dts/osta/otm/noise/health_effects/physics.html
 - http://www.ccohs.ca/oshanswers/phys_agents/noise_basic.html
 - <http://www.phys.unsw.edu.au/jw/dB.html>

The decibel (**dB**) is used to measure the intensity of sound. It uses a logarithmic scale and describes a ratio where 0 is at the threshold of human hearing. When measuring sound, filters are usually used. The A scale filter results in sound level meters called dBA that are less sensitive to very high or very low frequencies. The C filter provides more of a measurement of low frequency noise.

2009 MAINE MEDICAL ASSOCIATION WIND ENERGY RESOLUTION

Maine Medical Association

Resolution RE: Wind Energy and Public Health

WHEREAS, proposals to locate and build wind energy facilities in the State have at times proven controversial, due to concerns regarding potential effects of such facilities on the public health, and

WHEREAS, the trade off between the public good of generating electricity and the adverse health effects warrant appropriate evidence-based scientific research, and

WHEREAS, assessing the potential health impact of wind turbines has been difficult to measure but if present would be of significant concern. This is especially apparent regarding the noise level and other noise characteristics specific to industrial wind turbines, and

WHEREAS, there is a need for modification of the State's regulatory process for siting wind energy developments to reduce the potential for controversy regarding siting of grid-scale wind energy development and to address health controversy with regulatory changes to include, but not limited to:

- a) Refining certain procedures of the Maine Department of Environmental Protection and the Maine Land Use Regulation Commission to reflect scientific evidence regarding potential health effects, and to further explore such potential health effects;
- b) Judging the effects of wind energy development on potential public health by avoiding unreasonable noise and shadow flicker effects, with development setbacks and incorporating updated noise regulations specific for industrial wind turbines adequate to protect public health and safety.

Therefore be it resolved that the Maine Medical Association work with health organizations and regulatory agencies to provide scientific information of known medical consequences of wind development in order to help safeguard human health and the environment.

AND BE IT FURTHER RESOLVED that the Maine Medical Association 1) work with other stakeholders to encourage performance of studies on health effects of wind turbine generation by independent qualified researchers at qualified research institutions; 2) ensure that physicians and patients alike are informed of evidence-based research results.

